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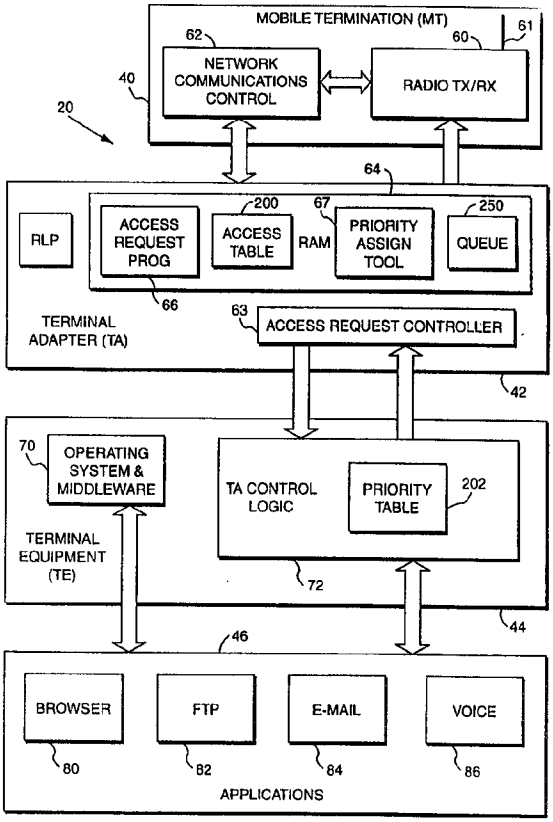
(54) Title: MULTIPLE ACCESS CATEGORIZATION FOR MOBILE STATION

(57) Abstract

A mobile station (20) for radio communications with a telecommunications network (18) has an access request controller (63) which controls whether a mobile termination unit (40) of the mobile station is to transmit access requests and/or data packets to the network from applications (46) correlated with one of plural access classes available to the mobile station. The access request controller has an access request table (200) which contains an access status for each of plural access classes utilizable by the mobile station. The access status for each of the plural access classes is received over the air interface (23) from the network. Each of the plural applications (46) provided at the mobile station is assigned a selectively changeable priority value by the user. The access request controller associates the priority value with one of the plural access classes in the access table (200). The access request controller consults the access table to determine whether an access request or a data packet from an application is to be sent to the network.



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MULTIPLE ACCESS CATEGORIZATION FOR MOBILE STATION

BACKGROUND

1. FIELD OF THE INVENTION

The present invention pertains to telecommunications, and particularly to the provision of multiple types of services for cellular or mobile telecommunications.

2. RELATED ART AND OTHER CONSIDERATIONS

In recent years cellular telephones have become increasingly popular. A cellular telephone is just one example of what is referred to in telephone parlance as a "mobile station" or "mobile terminal". Telecommunications services are provided between a cellular telecommunications network and a mobile station (e.g., cellular telephone) over an air interface, e.g., over radio frequencies. At any moment an active mobile station is communication over the air interface with one or more base stations. The base stations are, in turn, managed by base station controllers (BSCs). The base station controllers are connected via control nodes to a core telecommunications network. Examples of control nodes include a mobile switching center (MSC) node for connecting to connection-oriented, circuit switched networks such as PSTN and/or ISDN, and a general packet radio service (GPRS) node for connecting to packet-switched networks such as Internet, for example.

A mobile station can take on various forms other than a cellular telephone, including a computer (e.g., a laptop computer) with mobile termination capabilities. In some forms, mobile stations are capable of engaging in differing types of services, or multimedia services. In other words, the mobile station can execute several differing types of programs (i.e., "applications") which interact with the user. Examples of these

applications include Internet browsers and electronic mail programs. Several multimedia applications may reside in the same mobile station.

An owner of a mobile station typically enters into a contract or subscription agreement with a service provider (e.g., a company which operates the telecommunications network through which the mobile station engages in telecommunications connections). As part of the subscription agreement, the mobile station is categorized as belonging to one of several access classes available on the network. The particular access class to which a mobile station belongs determines the conditions under which the mobile station will be permitted to use resources of the cellular network. Examples of access classes are provided in GSM 04.08, TIA/EIA IS-136, and IS-95, for example.

In general, when a mobile station needs to access a cellular telecommunications network, the mobile station sends an access request message to the network over the air interface (e.g., the mobile station requests the set up of a "connection"). In the network, either the base station or the base station controller decides whether the mobile station is to be permitted use of a radio resource (e.g., a radio traffic channel) for the requested connection. The permission decision is based primarily upon the access class to which the mobile station belongs. The network may either grant or deny the request, depending on the preference given the mobile station's access class relative to network factors such as network congestion and the like.

As mentioned above, a mobile station may be capable of engaging in several different telecommunications services, and these services may be transacted simultaneously. Different types of telecommunications services may have differing sensitivities for delay. For some types of service, delay in transmissions may not be critical and it may very well be acceptable to wait for several minutes or even hours before the service request is executed. Such is more commonly the case of asynchronous types of services such as electronic mail (E-mail), for example. On the other hand, other types of services are more delay sensitive.

Currently, when a access request for a mobile station is denied by the network, the access requests are repeated by applications executed at mobile station until the

network grants the request. Unfortunately, the repeated access requests undesirably increases radio interference and system load. In a busy cellular communications, a large portion of the radio interference and system load is due to the sending and handling (e.g., denying) of accesses requests.

One technique for curtailing repeated access requests is for the network to broadcast periodically an access status to all mobile stations. In fact, in accordance with this technique the network broadcasts an access status for each of several access classes. Typically the network broadcasts the access status for a number of access classes to the mobile stations. The access status for each access class may be either "granted" or "denied", as appropriate.

Thus, the network has the capability of granting access for some access classes while denying access to other access classes. The access classes thereby form part of a priority mechanism and can be used to regulate the load caused by mobile stations attempting to access the network.

Heretofore each mobile station, or each subscriber identification module (SIM) card in the mobile station, has belonged only to one access class. This can prove a problem when the mobile station is equipped to execute multimedia applications. The multimedia applications may have varying tolerance for congestion and delay, and the one access class to which the mobile station is associated may not be appropriate for all services which can be performed at the mobile station. The inappropriateness is due at least in part to the fact that, as indicated above, some applications have higher tolerance for access delay than other applications.

It is theoretically possible at a mobile station separately to provide one type of subscription (e.g., a SIM module) for each type of application. However, practically this possibility poses problems for the user, such as e.g., the higher costs for multiple subscriptions and increased physical size of the mobile station.

What is needed, therefore, and an object of the present invention, is a mobile station which can be assigned plural access classes, as well as a flexible technique for handling access requests from such a mobile station.

BRIEF SUMMARY OF THE INVENTION

A mobile station for radio communications with a telecommunications network has an access request controller which controls whether a mobile termination unit of the mobile station is to transmit access requests and/or data packets to the network from applications correlated with one of plural access classes available to the mobile station. The access request controller has an access request table which contains an access status for each of plural access classes utilizable by the mobile station. The access status for each of the plural access classes is received over the air interface from the network. Each of the plural applications provided at the mobile station is assigned a selectively changeable priority value by the user. The access request controller associates the priority value with one of the plural access classes in the access table. The access request controller consults the access request table to determine whether an access request or a data packet from an application is to be sent to the network.

A list of access classes stored in the access table can be hardcoded or dynamically changeable either by the network or by the user. In one embodiment, the list of access classes is stored in a memory of a Subscriber Identity Module (SIM).

The access requests issued by the access request controller can include an access request on behalf of an application seeking a circuit-switched service, or an access request on behalf of an application seeking a packet-switched service. In the case of an access request on behalf of an application seeking a packet-switched service, a data packet is marked with its priority value. The access request controller matches the priority value with which the data packet is marked with an access class, and makes a determination based on the access class and the access status for that class whether the packet is to be forwarded to the network or queued.

When an access status for one of the plural access classes changes to an access permitted status, the access request controller waits a timeout period prior to forwarding the access request to the network.

Also provided is a method of operating a mobile telecommunications network wherein an inventive access status message is broadcast. The access status message includes access class status parameters for plural access classes, with each access class

being subdivided into plural subclasses. Differentiation of an access class into subclasses is an alternate way of providing multiple access categorization to a mobile station.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, features, and advantages of the invention will be apparent from the following more particular description of preferred embodiments as illustrated in the accompanying drawings in which reference characters refer to the same parts throughout the various views. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the invention.

Fig. 1 is a schematic view of an example telecommunications network in which the present invention operates.

Fig. 2 is a schematic view showing functional entities of a mobile station according to an embodiment of the invention.

Fig. 2Ais a schematic view showing functional entities of a mobile station according to another embodiment of the invention.

Fig. 3 is a schematic view showing a mapping of functional entities to hardware in a mobile station according to the embodiment of Fig. 2.

Fig. 3A is a schematic view showing a mapping of functional entities to hardware in a mobile station according to the embodiment of Fig. 3.

Fig. 4 is a diagrammatic view of an access table maintained by a mobile station according to an embodiment of the invention.

Fig. 5A is a diagrammatic view of the format of access class status parameters broadcast from a conventional network.

Fig. 5B is a diagrammatic view of the format of access class status parameters broadcast from a network in accordance with a mode of the present invention.

Fig. 6 is a diagrammatic view of the format of a communication priority window through which a user can set priority values relative to plural applications, as well as a priority table affected by such settings.

Fig. 7A is a diagrammatic view showing basic operations performed in a case in which access to a network is sought by an application which employs circuit data.

Fig. 7B is a diagrammatic view showing basic operations performed in a case in which access to a network is sought by an application which employs packet data.

Fig. 8 is diagrammatic view of a terminal adapter (TA) with a timer according to an embodiment of the invention.

Fig. 9 is diagrammatic view a charging function according to an embodiment of the invention.

Fig. 10 is a diagrammatic view of a request including an access class indication according to an embodiment of the invention.

Fig. 11A, Fig. 11B, and Fig. 11C are diagrammatic views of the mobile station of the embodiment of Fig. 2A showing differing modes of changing the contents of an access table stored in a SIM card.

DETAILED DESCRIPTION OF THE DRAWINGS

In the following description, for purposes of explanation and not limitation, specific details are set forth such as particular architectures, interfaces, techniques, etc. in order to provide a thorough understanding of the present invention. However, it will be apparent to those skilled in the art that the present invention may be practiced in other embodiments that depart from these specific details. In other instances, detailed descriptions of well known devices, circuits, and methods are omitted so as not to obscure the description of the present invention with unnecessary detail.

Fig. 1 shows a telecommunications network 18 in which a mobile station 20 communicates with one or more base stations 22 over air interface (e.g., radio interface) 23. Base stations 22 are connected by terrestrial lines to base station controller 24, also known as a radio network controller (RNC). Base station controller 24 is, in turn, connected through a control node known as the mobile switching center 26 to circuit-switched telephone networks represented by cloud 28; and through a GRPS control node 30 to packet-switched telephone networks represented by cloud 32.

As understood by those skilled in the art, when mobile station 20 is participating in a mobile telephonic connection, signaling information and frames of user information from mobile station 20 are transmitted over air interface 23 on designated radio channels to one or more of the base stations 22. The base stations have radio transceivers which transmit and receive radio signals involved in the connection. For information on the uplink from the mobile station 20 toward the other party involved in the connection, the base stations convert the radio-acquired information to digital signals which are forwarded to base station controller 24. Base station controller 24 orchestrates participation of the plural base stations 22 which may be involved in the connection, since mobile station 20 may be geographically moving and handover may be occurring relative to the base stations 22. On the uplink, base station controller 24 picks frames of user information from one or more base stations 22 to yield a coherent connection between mobile station 20 and the other party, whether that party be in PSTN/IDSN 28 or on the Internet 32.

It is the initiation of a connection by mobile station 20 to which the present invention primarily relates. One type of mobile station 20 with which the present invention is particularly useful is a computer with mobile termination, such as a laptop computer, for example. An illustrative embodiment of a suitable mobile station 20 for the present invention is provided in Fig. 2. As shown in Fig. 2, mobile station 20 has the following functional entities pertinent to the present invention: mobile termination entity (MT) 40; terminal adapter (TA) 42; terminal equipment 44; and a set 46 of applications. While each of these entities are described below, it should be understood that the invention is not confined to mobile stations having the same physical separation between functional entities, and that the present invention can be implemented in other than the described functional configuration.

Mobile termination entity (MT) 40, which is sometimes called the Mobile Equipment (ME), contains the radio transmitter/receiver TX/RX 60 (with antenna 61) and communications control 62 toward the network 18, e.g., the setup and release of radio connections, handover, etc. Mobile termination entity (MT) 40 can be a standard mobile pocket telephone (e.g., a GSM phone) or a phone card within mobile station 20.

Terminal adapter (TA) 42 acts as an adaptation between mobile termination entity (MT) 40 and the applications in the set 46 of applications. The terminal adapter (TA) 42 is typically realized as a Modem implemented on a PCMCIA (Personal Computer Memory Card International Association) card, which is inserted in a slot of terminal equipment 44. The terminal adapted (TA) 42 has a CPU 63 as well as a RAM 64 and a MT interface (I/F) 65. CPU 63 serves as an access request controller when executing an access request program 66 stored in RAM 64. As explained hereinafter, access request controller 63 of terminal adapter (TA) 42 selectively forwards call requests or data packets in accordance with access class status parameters received from network 18.

Terminal equipment 44 is normally a small computer (or computer platform), and as such includes both hardware and software. Terminal equipment 44 thus has typical aspects of a computer platform, e.g., a processor an operating system and middleware (Internet protocol suits, for example), collectively illustrated by reference numeral 70 in Fig. 2. In addition, terminal equipment 44 has control logic 72 (executed by the processor) for controlling terminal adapter (TA) 42. Control logic 72 performs set-up and release of calls to and from the network 18.

As shown in Fig. 2, the set 46 of applications illustrated for the example embodiment includes an Internet browser 80; a file transfer program (FTP) 82; an E-mail program 84; and voice service 86. Each application is normally a program which is executed by the processor of terminal equipment 44 and which interacts with the user via, e.g., data input devices such as a keyboard and/or mouse and output or display devices. These applications typically can run on any personal computer (with or without radio access). The applications in set 46 use a number of application programming interfaces (APIs) towards the terminal equipment 44. One or several of these APIs is for communications with the network 18. Examples of APIs are Unix

BSD Socket, WinSock or more telcom-specific APIs such as the Microsoft Intel Telephony API, AT&T, and Novell TSAPI or OnTheMove Mobile API. Thus, although the set 46 of applications is represented in Fig. 2 as an entity separate from terminal equipment 44, it should be understood that the set 46 of applications executed on the terminal equipment 44 if the terminal equipment 44 is a general computer, with the applications that are executed using the APIs offered by terminal equipment 44.

Fig. 3 shows how the functional entities of mobile station as illustrated in Fig. 2 are mapped onto hardware components of mobile station 20. In essence, Fig. 3 shows terminal equipment 44 wherein mobile termination entity (MT) 40 and terminal adapter (TA) 42 are cards situated in card slots. Terminal adapter (TA) 42 is connected to central processing unit (CPU) 100 by bus 102. Mobile termination entity (MT) is connected to MT interface 65 of terminal adapter (TA) 42 by a cable.

Memories of terminal equipment 44, particularly read only memory (ROM) 104 and random access memory (RAM) 106 are also connected to central processing unit (CPU) 100 by bus 102. In RAM 106 are stored the TA control logic 72, the set 46 of applications, and TCP/IP stack 108.

Terminal equipment 44 interfaces with a user through input device(s) 110 and output device(s) 112, each connected through respective appropriate interfaces 120 and 122 to bus 102. Input device(s) 110 can be a keyboard and/or mouse, for example, while output device(s) 112 can take the form of a display device, such as a LCD display panel, for example.

As indicated above, a subscription agreement exists for each mobile station 20. One pertinent term of the subscription agreement pertinent is the access class in which the mobile station is categorized. As explained previously, heretofore the subscription agreement for a mobile station assigned the mobile station to one and only one of several possible access classes. In accordance with an embodiment of the present invention, on the other hand, the subscription agreement for mobile station 20 permits mobile station 20 to participate in plural access classes. Since mobile station 20 has multimedia services as evidenced by the set 46 of applications executable thereon (see Fig. 2), participation by mobile station 20 in plural access classes affords the user an

opportunity to have its separate services seek access to network 18 using differing access criteria.

The subscription agreement terms are stored in an access table 200. Access table 200 is in RAM 64 of terminal adapter (TA) 42. An example access table 200X for one mode of the invention is shown in Fig. 4, which includes (in the left column thereof) a listing of each access type to which mobile station 20 can participate according to the subscription agreement. In particular, in the mode of Fig. 4 the applications in set 46 which are executed by mobile station 20 can be afforded one of access class C04, access class C09, or access class C14. How each application in set 46 is associated with one of the plural access classes available in accordance with the subscription agreement is described below in connection with a priority table 202 maintained by TA control logic 72.

Fig. 4 also shows, in the right hand column of access table 200, the status of each of the plural access classes as determined from network 18. At the moment in time shown in Fig. 4, the network precludes access classes C09 and C14 from requesting access to the network, while access class C04 is permitted access.

The base station controllers 24 of network 18 periodically broadcast access class status parameters over air interface 23. One example of the broadcasting of such access class status parameters occurs in the European GSM system wherein the access class status parameters take the form of RACH control parameters which are transmitted on the RACH channel. Fig. 5A shows a format of an information element containing the RACH control parameters, wherein octets 3 and 4 carry the access status bits for each of sixteen access classes (AC) C00 through C15.

Mobile termination entity (MT) 40 detects the access class status parameters (RACH control parameters) as these parameters are periodically or otherwise repetitively broadcast over air interface 23. The detected access class status parameters are sent to terminal adapter (TA) 42. As the access status for one or more of the access classes changes over time, terminal adapter (TA) 42 updates the status of the access classes which are pertinent for the subscription agreement of mobile station 20. For example, with reference to the mode shown in Fig. 4, for example, if the access status of

access class C09 were to change from "denied" to "permitted", terminal adapter (TA) 42 would note such change and accordingly update the "access status" column of access table 200X.

The fact that mobile station 20 has plural access classes available in accordance with its subscription agreement allows the user of mobile station 20 to differentiate on an access priority basis between the applications included in the set 46 of applications. In this regard, the user can execute a priority assignment program 210 (stored in RAM 106 [see Fig. 2]) for the purpose of assigning a priority to each of the applications in the set 46 of applications.

Fig. 6 is a diagrammatic view of a particular window, known as the priority assignment window 220, which is displayed on output device 112 during execution of priority assignment tool or program 210. The priority assignment tool 210 is preferably stored in RAM 64 of terminal adapter (TA) 42, but is executed by the terminal equipment 44. Alternatively, priority assignment tool 210 can be stored in the memory of terminal equipment 44 and executed by terminal equipment 44. The priority assignment tool 210 is aware of the fact that support for the priorities exists in terminal adapter (TA) 42 and in mobile station 20.

As is apparent from the priority assignment window 220, the user has already entered the network-related applications from the set 46 of applications into window 220. In particular, window 220 as seen in Fig. 2 already has the applications listed for "Web Browsing" (corresponding to browser application 80); an "E-mail" (corresponding to E-mail application 84); "File Transfer" (corresponding to FTP application 82); and "Voice" (corresponding to voice series 86). Moreover, in the "Priority" dialogue boxes which correspond to each application, the user has entered a default priority value. As is apparent by the priority values displayed in window 220, a lower numerical value indicates a higher priority. In this regard, "Web Browsing" (corresponding to browser application 80) and "File Transfer" (corresponding to FTP application 82) have both been assigned a relatively low priority("4") by the user, whereas the "E-mail" application has been assigned a medium priority ("3") and "speech" (corresponding to voice application 86) as been assigned a high priority ("2"). The default priority can be overridden by the user e.g., by selecting an icon or button

indicative of an "urgent mode" while in the application itself. This temporary change of priority must be supported by the application in some way, e.g., by having an "urgent" button in a graphical interface of an E-mail program, for example.

As the user makes or changes priority assignments via priority assignment window 220 during execution of priority assignment program 210, the priority table 202 is likewise updated as also reflected in Fig. 6. When priority table 202 is initialized or updated, TA control logic 72 sends the contents of priority table 202 to terminal adapter (TA) 42. Access request controller 63 of terminal adapter (TA) 42 makes an association between each of the priorities assigned by the user (e.g., in priority assignment window 220) with one of the access classes permitted by the subscription agreement (e.g., in the example of Fig. 4, one of access classes C04, C09, or C14). Access request controller 63 is also involved, as hereinafter explained, in determining when an access request from one of the applications in the set 46 of applications can make an access request to the network 18.

At this point it should be kept in mind that some of the applications in the set 46 of applications may involve packet data, while others of the applications may involve circuit data. Although generally the same in principle regarding the present invention, the cases of packet data and circuit data are separately discussed and illustrated.

The case of seeking access by an application which employs circuit data is shown in Fig. 7A. Operation 7A-1 reflects the repeated broadcast of access class status parameters (RACH control parameters) by the network 18. Upon reception of the access class status parameters by mobile termination entity (MT) 40, the access class status parameters are forwarded to terminal adapter (TA) 42 as indicated by operation 7A-2. As shown by operation 7A-3, access request controller 63 of terminal adapter (TA) 42 updates its access table 200 (see Fig. 4 for an example) using the access class status parameters.

Fig. 7A next shows, as operation 7A-4, a circuit data-based application (e.g. voice application 86) seeking access to network 18 by way of a call request. The call request of operation 7A-4 is handled by TA control logic 72, which (as indicated by operation 7A-5) notes from priority table 202 the particular priority presently assigned

to the requesting application. For example, in the case of the circuit data-based application being speech, TA control logic 72 would associate a priority value of "2" with the call request. TA control logic 72 then forwards the call request plus the priority value to access request controller 63 of terminal adapter (TA) 42 as indicated by operation 7A-6.

At operation 7A-7 the access request controller 63 of terminal adapter (TA) 42 maps the priority value received from the call request to one of the plural access classes permitted to mobile station 20 under the subscription agreement. Access request controller 63 has a mapping function that relates the priority values of priority table 202 to the access classes of access table 200. Using the illustration of Fig. 4 and the priority assignments shown in Fig. 6, an example mapping performed by access request controller 63 could be as follows: high priority (e.g., "2") is mapped to access class C04; medium priority (e.g., "3") is mapped to access class C09; and low priority (e.g., "4") is mapped to access class C14.

The priority/access class mapping of operation 7A-7, which results in association of an access class with the call request, at operation 7A-8 the access request controller 63 determines from access table 200 whether network access is presently permitted for the access class now associated with the application making the request. For example, if the access class associated with the requesting application were access class C02, at the time shown in Fig. 4 it would be realized by terminal adapter (TA) 42 that the network 18 is presently permitting access. In such case, access request controller 63 would forward a connection request (operation 7A-9) to mobile termination entity (MT) 40, which thereafter would communicate with the network 18 in conventional fashion (indicated by operation 7A-10) for setting up the connection with the requesting applications program.

On the other hand, if the access status associated with the requesting applications program has a "denied" status as discerned by access request controller 63 from access table 200, the access request controller 63 via terminal equipment 44 would so advise the requesting applications program. In the access denial scenario, the requesting application can be advised to reattempt the access at a later date. Alternatively, the requesting applications program may be put on hold for a predetermined period of time

while access request controller 63 waits to ascertain whether the access status for the associated access class happens to change during the predetermined wait or hold period.

In the example of Fig. 7A, it should be understood that the access class status parameters are repetitively transmitted from the network 18 to mobile station 20, and that the operations 7A-1 through 7A-3 can be performed at differing times. In fact, an instance of operations 7A-1 through 7A-3 could be performed at the time of or just before the call request with priority value is sent to access request controller 63, e.g., the time of operation 7A-6, for example.

The case of seeking access by an application which employs packet data but which does not use a call setup phase is shown in Fig. 7B. A packet data call may include a call setup phase, which is similar to the setup of a circuit data connection as above described. The difference is the data transfer phase which is described below, where a second level of access load control is accomplished.

In the case of an application which employs packet data but which does not use a call setup phase, the mobile termination entity (MT) 40 of mobile station 20 routinely receives the access class status parameters broadcast from the network 18, in the manner aforedescribed. Operations 7B-1 through 7B-3 correspond to operations 7A-1 through 7A-3 previously described for the respective reception of the access class status parameters, transmission thereof to access request controller 63 [operation 7B-2], and updating of the priority table 202 (operation 7B-3).

Operation 7B-4 occurs as one of the applications in the set 46 of applications seeks, via TCP/IP 106, to send a data packet (e.g., an Internet packet) to the network 18. Initially the data packet is sent to a "Prioritizer", e.g., to TA control logic 72. As shown by operation 7B-5, the "Prioritizer" checks the priority table 202 and associates a priority value with the particular application which desires to send the data packet, and thus associates the priority value with the data packet itself. The association of priority value with the data packet (based on the application program seeking to send the data packet) is understood with reference to Fig. 6 as discussed above. Thus, the "Prioritizer" essentially "marks" the data packet with a priority value.

As shown by operation 7B-6, the data packet with its associated priority is forwarded by TA control logic 72 to access request controller 63. Operation 7B-7 shows terminal adapter (TA) 42 queuing the data packet in a packet queue 250 for transfer to the network 18. Packet queue 250 can reside in RAM 64 of terminal adapter (TA) 42. When the marked data packet comes to the head of queue 250, as indicated by operation 7B-8 the access request controller 63 maps the priority value with which the data packet is marked to one of the access classes designated in the subscription agreement for base stations 22. The mapping of operation 7B-8 is essentially the same as that of operation 7A-7, with the exception that the mapping is for a data packet rather than a call request. At operation 7B-9 the access request controller 63 determines from access table 200 whether network access is presently permitted for the access class now associated with the data packet at the top of queue 250.

If the access table 200 indicates that the access status for the access class associated with data packet is a "denied" status, access request controller 63 maintains the data packet in queue 250 for a predetermined period of time. If, within that predetermined period of time, the access status for the access class of the data packet changes to a "permitted" status, the data packet is taken from the head of queue 250 and passed to mobile termination entity (MT) 40 for transmission to the network 18.

Should it ever occur that queue 250 gets overloaded with data packets, lower-prioritized packets in queue 250 are discarded. The TCP/IP protocol 106 has a control mechanism which handles any extra delay caused by overload of queue 250. It should be understood that queue 250 can represent plural buffers. Moreover, some or all of the buffering provided by queue 250 can be distributed to RAM 106 of terminal equipment 44 if desired.

When the access table 200 indicates that the access status for the access class associated with the data packet is "permitted", the data packet is sent from access request controller 63 of terminal adapter (TA) 42 to mobile termination entity (MT) 40 as indicated by operation 7B-10 in Fig. 7B. In usual fashion, mobile termination entity (MT) 40 then sends a request for a channel (operation 7B-11). In response, a channel assignment is received from network 18 . The mobile termination entity (MT) 40 is then able to send the data packet over the assigned channel. After transmission of the

data packet to network 18, the network 18 sends an acknowledgment which is forwarded to terminal adapter (TA) 42.

Now that access request has been described, both with reference to circuit data (Fig. 17A) and packet data (Fig. 17B), an example is now provided wherein it is desirable to change the priority value assigned to one of the applications in the set 46 of applications. At the time shown in Fig. 6, the window 220 indicates that the file transfer program (FTP) 82 has a low priority (i.e., a priority value of "4"). File transfer typically may not be a very urgent matter, so that if the network 18 is congested it is of little consequence that transfer of the file may be postponed. On the other hand, if the user is about to board an aircraft (in which operation of the mobile station is not permitted) and there is a need to transfer a file to an eager recipient, the present invention permits the file transfer program (FTP) to use temporarily a higher priority value (e.g., a higher access class). To do so, with the input device 110 (e.g., a mouse) the user changes the priority value in the dialogue box for the file transfer program (FTP) to obtain a lower number (it being remembered that lower numbers correspond to higher priority values). Thus, using the higher priority value, the user would be able to send the necessary files despite network congestion which otherwise might have precluded file transfer at the original priority value assigned to the file transfer program (FTP).

As mentioned above, the contents of access table 200 is established in accordance with the subscription agreement between the operator of the network 18 and the user (e.g., owner) of mobile station 20. In one embodiment of the invention, the subscription-determined contents of access table 200 is hardcoded in the memory of terminal adapter (TA) 42. In this embodiment, the access classes in which mobile station 20 can participate will always be the same access classes as initially established and hardcoded into access table 200.

In other embodiments of the invention, the terms of the subscription agreement for mobile station 20 can change so that mobile station 20 can be usable with other access classes. For example, the user or subscriber can contact the network operator and request a change of terms regarding the subscription agreement, e.g., negotiate new terms for the subscription agreement. In such case, the contents of access table 200 can be changed to reflect the re-negotiated terms (e.g., new access classes). In particular,

the network operator can download through the network 18 a new access table 200 to replace the prior access table 200. In this manner, the subscriber can update or otherwise modify the access table 200 in accordance with changed terms of the subscription agreement. Alternatively, the user or subscriber can himself modify the contents of access table 200. The user-implemented modification of access table 200 can be accomplished, if desired, by a special function of priority assignment program 210. Of course, any change of subscription agreement terms such as a change of available access classes can trigger new or additional charges when new access classes are utilized. Moreover, the mere ability for the user to change access classes at the user's initiative incur a greater subscription fee or be a chargeable event.

Another illustrative embodiment of a suitable mobile station 20A for the present invention is provided in Fig. 2A and Fig. 3A.. As shown in Fig. 2A, mobile station 20A has the same basic type of functional entities as the mobile station 20A. However, the mobile station 20A of the embodiment of Fig. 2A and Fig. 3A has a Subscriber Identity Module (SIM) 260 [also know as a SIM card] included in mobile termination entity (MT) 40. Subscriber Identity Module (SIM) 260 has its own CPU 262 and memory (RAM) 264. Through appropriate interface(s), Subscriber Identity Module (SIM) 260 is connected to the network communications control 62 of mobile termination entity (MT) 40, as well as to terminal equipment 44.

Rather than having an access table stored in terminal equipment 44 as in the embodiment of Fig. 2 and Fig. 3, the mobile station 20A of the embodiment of Fig. 2A and Fig. 3A has access table 200SIM stored in memory 264 of Subscriber Identity Module (SIM) 260. Thus, for mobile station 20A, the conditions or terms of the mobile subscription agreement (e.g., access classes) are stored in access table 200SIM of Subscriber Identity Module (SIM) 260.

Upon startup, terminal equipment 44 can read the list of access classes from access table 200SIM of Subscriber Identity Module (SIM) 260. As the access request controller 63 executes the access request program 66, the access class values stored in access table 200SIM are utilized in connection with the performance of operations such as those discussed with reference to the embodiment of Fig. 2 and Fig. 3.

Moreover, in the event that the Subscriber Identity Module (SIM) 260 has satisfactory capacity and processing, the CPU 262 of Subscriber Identity Module (SIM) 260 can serve, at least in part, as the access request controller 63. In this regard, some or all of access request program 66 can be stored in memory 264 of Subscriber Identity Module (SIM) 260.

There are several ways of changing the conditions or terms (e.g., access classes) for the SIM card-containing mobile station 20A. A first way of changing access classes, as shown in Fig. 11A, is to replace a first Subscriber Identity Module (SIM) 260(1) [having a first set of access classes] with a second Subscriber Identity Module (SIM) 260(2) [having a second set of access classes]. A second way of changing access classes (shown in Fig. 11B) is to remove the original Subscriber Identity Module (SIM) 260 contained in the mobile station 20A and take the Subscriber Identity Module (SIM) 260 to a programming device 1100. In this second way, the access table 200SIM of the Subscriber Identity Module (SIM) 260 is reprogrammed with updated or revised access class information, so that the original but reprogrammed Subscriber Identity Module (SIM) 260' can be returned to mobile station 20A. A third way (shown in Fig. 11C) of changing access classes stored in access table 200SIM of Subscriber Identity Module (SIM) 260 is for the network (at the behest of e.g., the service provider) to send a special access table message ("AT MESSAGE") to mobile station 20A, the access table message serving to down load the contents of a replacement access table into access table 200SIM.

In its various embodiments the invention thus permits mobile station 20 to participate in plural access classes. In this regard, it should be realized that the invention extends to a situation in which a network provides access classes, with one or more access classes having access subclasses. In such a situation, it should be understood that in the present invention the mobile station 20 can participate in more than one access class, or can participate in plural access subclasses for one or more than one access class.

In the above regard, the network 18 can send out a message similar to that containing the RACH control parameters as pictured in Fig. 5A, but having subclass values for each of the access classes. An example of such a message is illustrated in

Fig. 5B. The network message of Fig. 5B has access status for sixteen access classes, and more particularly for four subclasses for each of the sixteen subclasses. The network message of Fig. 5B has eight octets. The first four bits a1, a2, a3, and a4 of the first octet carry access status for each of the four corresponding subclasses of the first access class. The last four bits b1, b2, b3, and b4 of the second octet carry access status for each of the four corresponding subclasses of the second access class. In similar manner, each of the remaining seven octets carry access status bits for the subclasses of two access classes: the second octet for the third and fourth access classes, the third octet for the fifth and sixth access classes, and so forth.

The person skilled in the art knows how to format a network message such as the RACH control parameter message of Fig. 5A, and how to broadcast the same over the air interface 23. Now that it is realized by the present invention that an access subclass scheme is also possible, the person skilled in the art is able to implement the change in format of the network message of Fig. 5B and to transmit the same.

With the subclass-based network message of Fig. 5B, it is possible to assign an access class to a mobile station in its subscription agreement, but also to allow the mobile station to participate in plural subclasses of the assigned access class. In a more complex arrangement, the mobile station may participate in access subclasses of plural access classes, if desired.

Thus, in view of the foregoing, the term "access class" as used herein is understood to refer to any type of access categorization, including the access subclass scenario described above. Advantageously, the present invention enables mobile station 20 to participate in plural access categorizations, e.g., plural access classes or plural access subclasses.

It should be recognized that mobile stations are capable of handling more than one simultaneous call and more than one simultaneous connection. In other words, more than one applications program may simultaneously be involved with a connection to network 18. Moreover, several of these calls from the applications program may use the same connection (e.g., the same radio channels over the air interface 23, for example). When services are simultaneously used, the terminal adapter (TA) 42 may choose either (1) to

use a radio connection already in use by an existing call or (2) to setup a new radio connection. If an already existing radio connection was used by a call with lower priority, then a new connection may not be necessary.

In the embodiments described herein, the priority value assigned by the user to the applications in the set 46 of applications has a relationship to, but is not necessarily the same as, access class. It should be understood that for sake of simplification, for example, the priority value and access class may be the same. That is, in setting priority values in window 220 of Fig. 6, the numbers selected by the user may actually be access class numbers.

The moment that an access status changes from "denied" to "granted" for a particular access class, there yet may be a tendency for the network to overload with a burst of access requests. Another embodiment of the terminal adapter (TA), shown as terminal adapter (TA) 842 in Fig. 8A, has a timer 860 which attempts to ameliorate this problem. Timer 860 has a time value stored therein. When the access status changes for an access class involved in mobile station's subscription agreement, terminal adapter (TA) 842 waits for a timeout corresponding to the value in timer 860 before forwarding the call request or data packet to mobile termination entity (MT) 40.

The time value stored in timer 860 can be, for example, a random number computed by mobile station 20. In this way, numerous access requests from many mobiles waiting for access can be linearly distributed (e.g., between O and Y milliseconds), relieving the load on the network. The value of Y is set by the network operator, or is a fixed value.

Employment of the timeout value smoothes the burst of access requests from the mobile stations. Alternatively, the timer can be located in mobile termination entity (MT) 40, and started by terminal adapter (TA) 842 when the change of access status is detected. It should also be understood that the timer 860 and timeout prior to sending an access request is not confined to embodiments wherein the mobile station participates in plural access classes, but that the timeout principle also applies to the traditional mobile station having only one access class.

As mentioned above, the user or subscriber can be charged different rates for connections of differing priorities. When a user assigns to an application program a priority level that is more likely to have a denied access status (likely for an application that has higher tolerance for delay), the user is not billed as much for the connection as if the user had selected a more favorable priority for a less restricted access class.

Fig. 9 shows mobile station sending a "request" 900 (which can be either an access request or channel request according to whether the service is for circuit-switched or packet-switched data) to network. At least some of the contents of the request 900 is ultimately routed (e.g. by diversity handling at a base station controller 24) to a control node CN. Control node CN can be a MSC for circuit-switched data or a GPRS control node for packet-switched data. As shown in Fig. 9, control node includes a service switching part SSP, a service control part SCP, and a database CNDB.

As shown in Fig. 10, the request 900 includes an access class indicator ACI. For the access class scheme of Fig. 5A, the access class indicator ACI can be four bits in length, since the sixteen access courses of the Fig. 5A scheme are representable by four bits. For the access class scheme of Fig. 5B (which has access subclasses), the access class indicator ACI can be six bits in length, with four bits utilized to express the access class and two bits utilized to express the particular subclass of the expressed access class.

The database (CNDB) of control node CN has a record 910 for each subscriber. The record indicates the access classes (and access subclasses where applicable) permitted for use by the subscriber in accordance with the terms of the subscriber's subscription agreement. For example, record 910 has fields PAC1...PACn reflecting permitted access classes 1-n for the subscriber.

When request 900 is received at control node CN, the request 900 is sent by the SSP to the service control part SCP, as indicated by event 9-1. Using the access class indicator ACI contained in request 900, as evidenced by event 9-2, the SCP checks the subscriber's record in database CNDB to ensure that the access class indicator ACI of the request 900 is in one of the permitted access class (PAC) fields of record 910. If not, the request is denied. If the check is positive, the request is granted and service control part SCP performs a charging function for the call. In this regard, service control part

determines the current rate for the particular access class indicated by the access class indicator ACI, and based on other factors such duration of call or number of packets, etc. determines a financial charge for the call. As indicated above, an access class which has a low probability for having access status denied can be charged at a higher rate.

One specific non-limiting example of a particular type of network 18 (see Fig. 1) with which the present invention can be employed is a code division multiple access (CDMA) mobile telecommunications system. In a CDMA system, the information transmitted between each base station 22_1 through 22_n and the mobile station is modulated by a different mathematical code (such as a spreading code) to distinguish it from information for other mobile stations which are utilizing the same radio frequency. Thus, in CDMA, the individual radio links are discriminated on the basis of codes. In addition, in CDMA mobile communications, typically the same baseband signal with suitable spreading is sent from several base stations (e.g., base stations 22_1 through 22_n) with overlapping coverage. The mobile station can thus receive and use signals from several base stations simultaneously. Moreover, since the radio environment changes rapidly, a mobile station likely has radio channels to several base stations at the same moment, e.g., so that the mobile station can select the best channel and, if necessary, use signals directed to the mobile from various base stations in order to keep radio interference low and capacity high. This utilization of radio channels from multiple base stations by a mobile station in a CDMA scheme is termed "soft handover." Additional details of diversity and soft handover are provided e.g., by United States Patent Application Serial Number (attorney docket 2380-3) filed November 26, 1997, entitled "Multistage Diversity Handling for CDMA Mobile Telecommunications", and United States Patent Application Serial Number (attorney docket 2380-4) filed November 26, 1997, entitled "Diversity Handling Moveover for CDMA Mobile Telecommunications", both of which are incorporated herein by reference.

In the example illustrated embodiment, base stations 22, base station controller 24, mobile switching center (MSC) 26, and GPRS control node 30 are each ATM-based nodes. As such, each of these nodes has an ATM switch. It should be understood, however, that the present invention is not confined to ATM packets or to employment of ATM switches.

It should be understood that, unless specifically stated to the contrary, reference to any mobile station herein expressly includes mobile station 20A of the embodiment of Fig. 2A and Fig. 3A. In fact, the teachings of the invention are applicable to all embodiments herein disclosed. For example, the teachings of Fig. 8 and Fig. 9 are equally applicable to the embodiment of Fig. 2A and Fig. 3A as to the embodiment of Fig. 2 and Fig. 3.

The present invention allows a mobile station to have multiple access classes without increasing cost or size of the mobile station itself. Having the benefit of plural access classes, at a peak traffic hour the mobile station can move some of its traffic to a lower priority, and hence possibly to another time, thereby better utilizing resources of the network. Moreover, the present invention facilitates an orderly placement of access requests in accordance with a prioritized order after network congestion diminishes. Further, as explained in connection with Fig. 9, for example, the network operator can charge for different delay requirements while yet maintaining just one subscription per user.

While the invention has been described in connection with what is presently considered to be the most practical and preferred embodiment, it is to be understood that the invention is not to be limited to the disclosed embodiment, but on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims.

WHAT IS CLAIMED IS:

1. A mobile station for radio communications with a telecommunications network, the mobile station comprising:

a mobile termination unit which handles radio communications over an air interface with the network;

an access request controller which controls whether the mobile termination unit is to transmit one of (1) an access requests, and (2) data packets, for each of plural access classes of the network.

2. The apparatus of claim 1, wherein the access request controller has an access request table which contains an access status for each of plural access classes utilizable by the mobile station, and wherein the access request controller consults the access request table to determine whether one of (1) an access request, and (2) data packet is to be sent to the network for a selected one of plural services provided at the mobile station.

3. The apparatus of claim 1, wherein the access status for each of the plural access classes is received over the air interface from the network.

4. The apparatus of claim 1, further comprising plural applications executable at the mobile station, and wherein each of the applications is assigned a priority value, and wherein the priority value correlates to one of the plural access classes.

5. The apparatus of claim 4, wherein the priority value assigned to each of the applications is changeable by the user.

6. The apparatus of claim 3, wherein a list of access classes available to the mobile station is hardcoded in a memory of the mobile station.

7. The apparatus of claim 3, wherein a list of access classes available to the mobile station is stored in a memory of the mobile station, and wherein a user of the mobile station can change contents of the list.

8. The apparatus of claim 1, wherein a list of access classes available to the mobile station is stored in a memory of a SIM card of the mobile station.

9. The apparatus of claim 8, wherein the memory is reprogrammable for changing the list of access classes..

10. The apparatus of claim 8, wherein the list of access classes is changeable by an access table message transmitted by the telecommunications network.

11. The apparatus of claim 1, wherein the access requests transmitted by the access request controller is on behalf of an application seeking a circuit-switched connection.

12. The apparatus of claim 1, wherein the data packet transmitted by the access request controller is on behalf of an application seeking a packet-switched service.

13. The apparatus of claim 1, wherein when an access status for one of the plural access classes changes to an access permitted status, the access request controller waits a timeout period prior to forwarding one of (1) the access request and (2) the data packet to the network.

14. The apparatus of claim 1, wherein the access request controller is situated (1) a terminal adapter and (2) terminal equipment.

15. A mobile station for radio communications with a telecommunications network, the mobile station comprising:

a mobile termination unit which handles radio communications with the network;

an access request controller;

terminal equipment connected to the mobile terminal unit;

plural applications executable on the terminal equipment;

wherein, at the access request controller, each of the plural applications is associated with one of plural access classes allotted to the mobile station,

wherein, for each of the plural access classes available to the mobile station, the access request controller stores an access status as received from the network; and

wherein, when one of the applications requires access to the network, the access request controller determines whether to send one of (1) an access request and (2) a data packet to the network in accordance with the stored access status of the associated access class.

16. The apparatus of claim 15, wherein each of the plural applications is associated with one of plural access classes by a priority value, the apparatus further comprising a memory wherein is stored an application/priority table in which each of the plural multimedia applications is assigned a priority value, and wherein the access request controller associates the priority value with an access class.

17. The apparatus of claim 16, wherein the priority value assigned to each of the applications is changeable by the user.

18. The apparatus of claim 15, wherein a list of access classes available to the mobile station is hardcoded in a memory of the mobile station.

19. The apparatus of claim 15, wherein a list of access classes available to the mobile station is stored in a memory of the mobile station, and wherein a user of the mobile station can change contents of the list.

20. The apparatus of claim 15, wherein a list of access classes available to the mobile station is stored in a memory of a SIM card of the mobile station.

21. The apparatus of claim 20, wherein the memory is reprogrammable for changing the list of access classes.

22. The apparatus of claim 20, wherein the list of access classes is changeable by an access table message transmitted by the telecommunications network.

23. The apparatus of claim 15, wherein the access requests sent by the access request controller are on behalf of an application seeking a circuit-switched connection.

24. The apparatus of claim 15, wherein the data packets sent by the access request controller are on behalf of an application seeking a packet-switched service.

25. The apparatus of claim 15, wherein when an access status for one of the plural access classes changes to an access permitted status, the access request controller waits a timeout period prior to forwarding one of (1) the access request and (2) the data packet to the network.

26. The apparatus of claim 15, wherein the access request controller is situated in one of (1) a terminal adapter and (2) terminal equipment.

27. Method of operating a mobile station in radio communications with a telecommunications network, the method comprising:

(1) providing plural service applications at the mobile station; and

(2) associating one of plural access classes available to the mobile station with an application desiring to make a transmission of one of (1) an access request and (2) a data packet;

(3) determining, on the basis of the access class associated with the application, whether the desired transmission of step (2) is to be forwarded to the network..

28. The method of claim 27, further comprising receiving a set of access class status parameters available to the mobile station over an air interface with the network.

29. The method of claim 27, further comprising:

assigning a priority value to the application; and

when the application desires to make an access request, associating the priority value with one of the plural access classes available to the mobile station.

30. The method of claim 28, further comprising selectively changing the priority value assigned to the application.

31. The method of claim 27, wherein the determination of step (3) is performed by consulting an access table which contains an access status for each of plural access classes available to the mobile station.

32. The method of claim 31, further comprising receiving the access status for each of the plural access classes over the air interface from the network.

33. The method of claim 27, further comprising hardcoding in the access table a list of access classes available to the mobile station.

34. The method of claim 31, further comprising permitting the user to change a list of access classes in the access table.

35. The method of claim 31, further comprising:

storing in a memory of a SIM card of the mobile station a list of access classes available to the mobile station; and

using the list of access classes as the plural access classes of step (2).

36. The method of claim 35, further comprising reprogramming the memory to update the list of access classes.

37. The method of claim 35, further comprising changing the list of access classes in accordance with an access table message transmitted by the telecommunications network.

38. The method of claim 27, wherein the access requests issued by the access request controller includes an access request on behalf of an application seeking a circuit-switched connection.

39. The method of claim 27, wherein the access requests issued by the access request controller include an access request on behalf of an application seeking a packet-switched connection.

40. The method of claim 27, further comprising waiting a predetermined timeout period prior to forwarding the transmission of step (2) to the network.40. Method of operating a mobile telecommunications network having access classes, the method comprising:

broadcasting a message including access class status parameters having access status information for plural access classes to a mobile station;

including in the message access status information for at least one of plural access subclasses for at least one of the plural access classes.

41. The method of claim 41, wherein the message has a bit associated with each of the plural access subclasses.

42. A computer program product having instructions stored in a memory and executable on a processor for associating an application resident at a mobile station with one of plural access classes of a telecommunications network available to the mobile station.

43. The product of claim 43, further comprising consulting an access request table which contains an access status for each of the plural access classes utilizable by the mobile station to determine whether one of (1) an access request, and (2) data packet is to be sent to the network.

Fig. 1

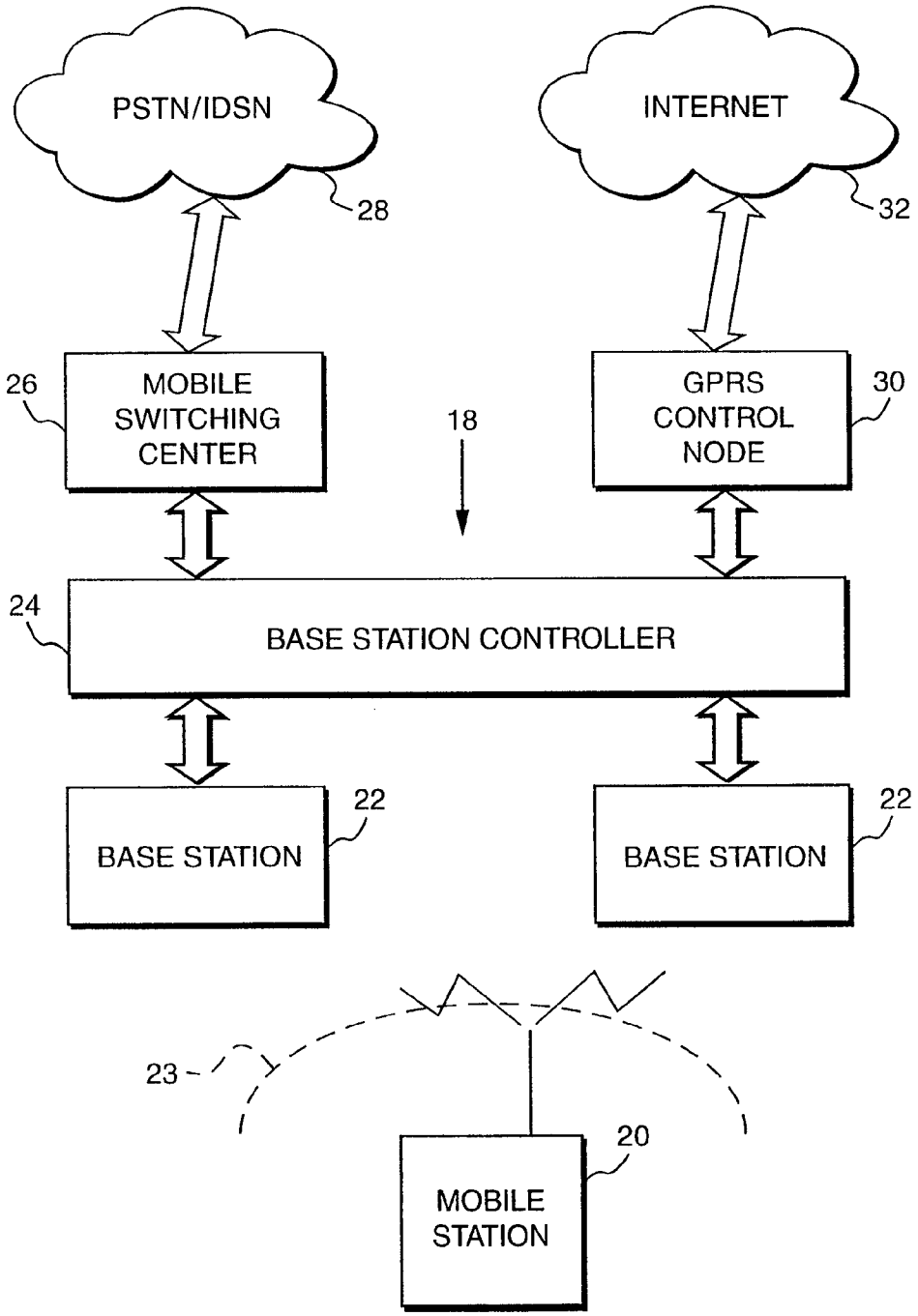

PSTN/IDSN
28
INTERNET
32
26
MOBILE SWITCHING CENTER
18
GPRS CONTROL NODE
30
24
BASE STATION CONTROLLER
BASE STATION
22
BASE STATION
22
23
20
MOBILE STATION

Fig. 2

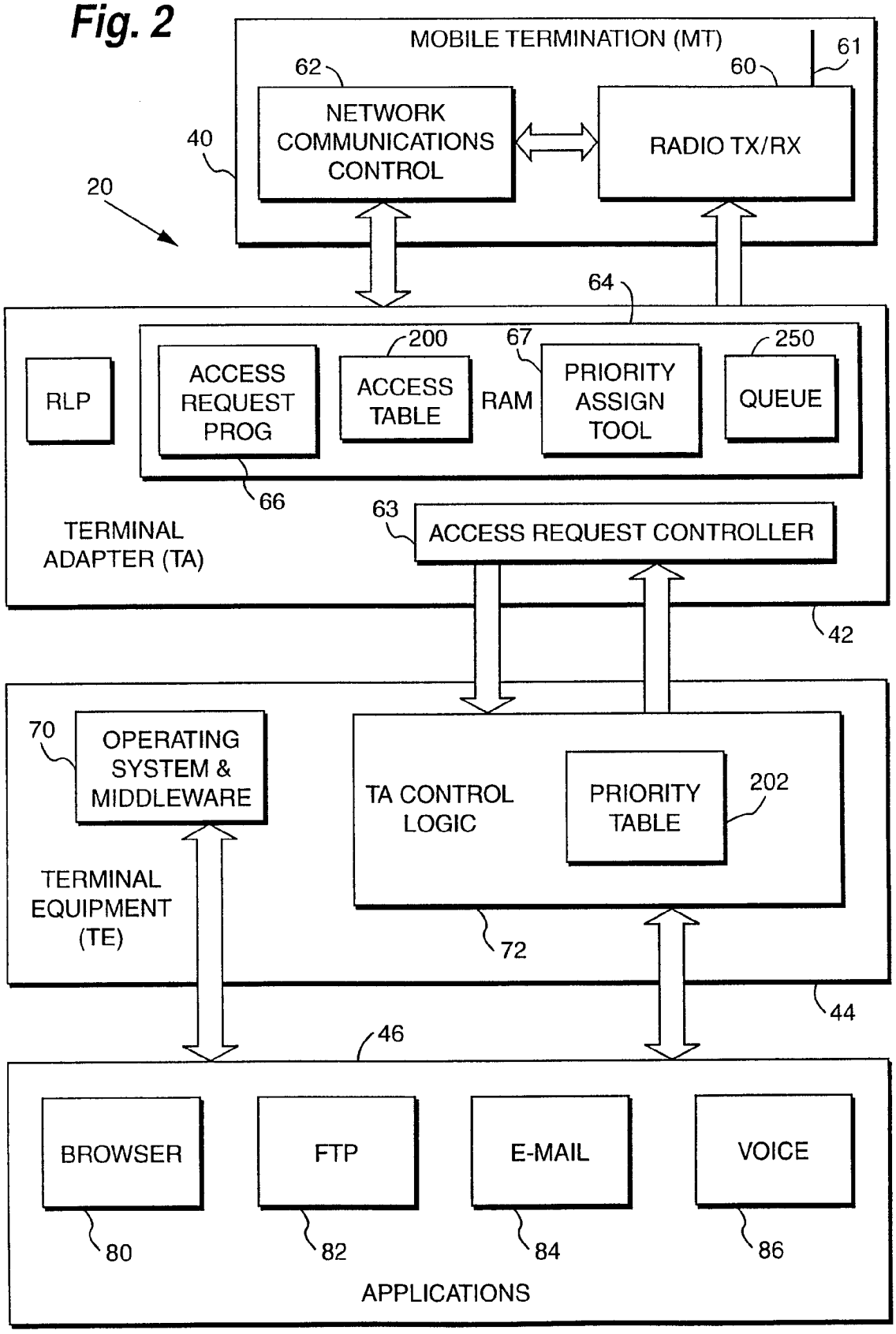
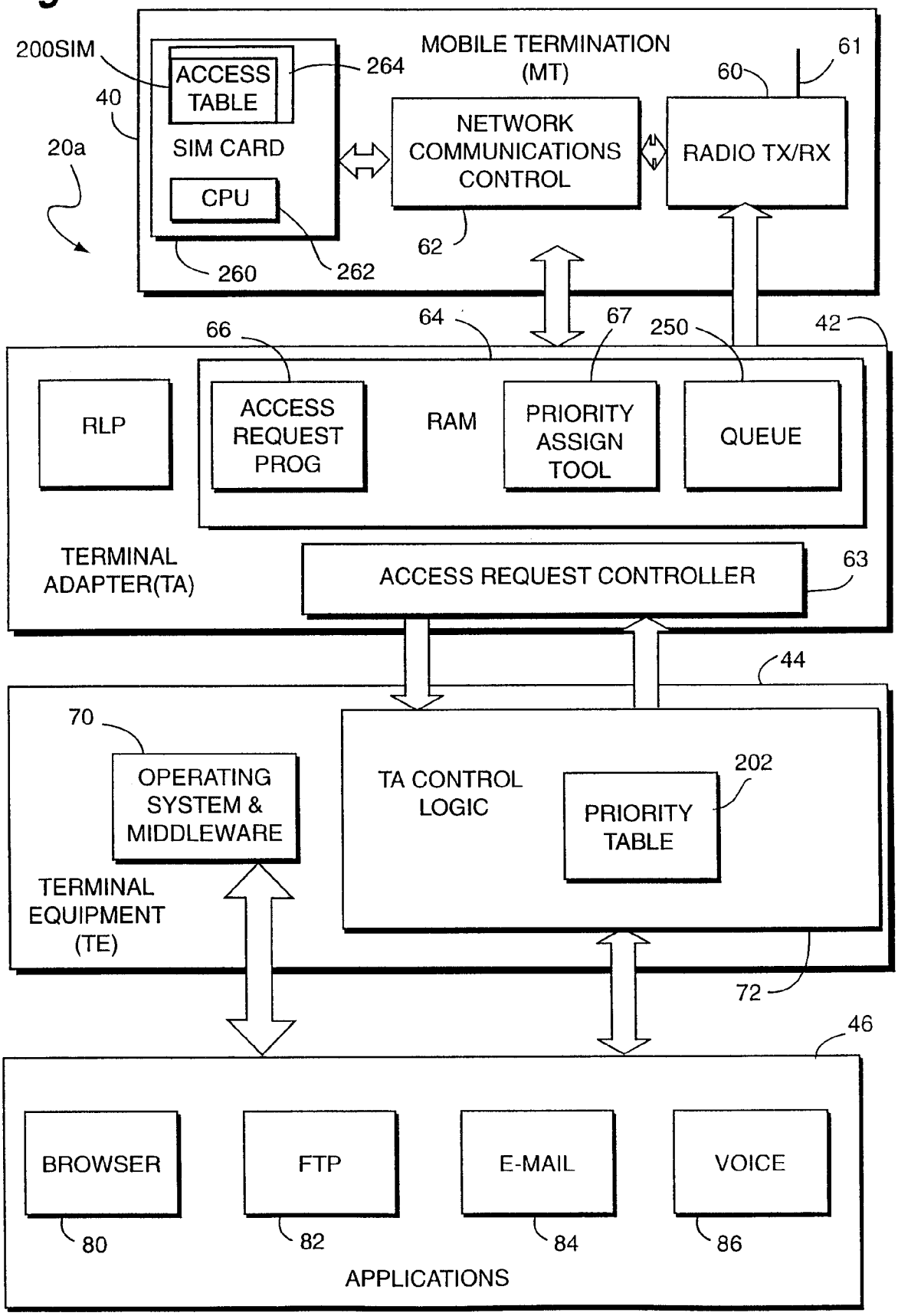

MOBILE TERMINATION (MT)
61
62
60
NETWORK COMMUNICATIONS CONTROL
RADIO TX/RX
40
20
64
RLP
ACCESS REQUEST PROG
200
ACCESS TABLE
67
RAM
PRIORITY ASSIGN TOOL
250
QUEUE
66
TERMINAL ADAPTER (TA)
63
ACCESS REQUEST CONTROLLER
42
70
OPERATING SYSTEM & MIDDLEWARE
TA CONTROL LOGIC
PRIORITY TABLE
202
TERMINAL EQUIPMENT (TE)
72
44
46
BROWSER
FTP
E-MAIL
VOICE
80
82
84
86
APPLICATIONS

Fig. 2A


200SIM
ACCESS TABLE
264
40
SIM CARD
20a
CPU
260
262
MOBILE TERMINATION (MT)
61
60
NETWORK COMMUNICATIONS CONTROL
RADIO TX/RX
62
64
66
67
250
42
RLP
ACCESS REQUEST PROG
RAM
PRIORITY ASSIGN TOOL
QUEUE
TERMINAL ADAPTER(TA)
ACCESS REQUEST CONTROLLER
63
44
70
OPERATING SYSTEM & MIDDLEWARE
TA CONTROL LOGIC
202
PRIORITY TABLE
TERMINAL EQUIPMENT (TE)
72
46
BROWSER
FTP
E-MAIL
VOICE
80
82
84
86
APPLICATIONS

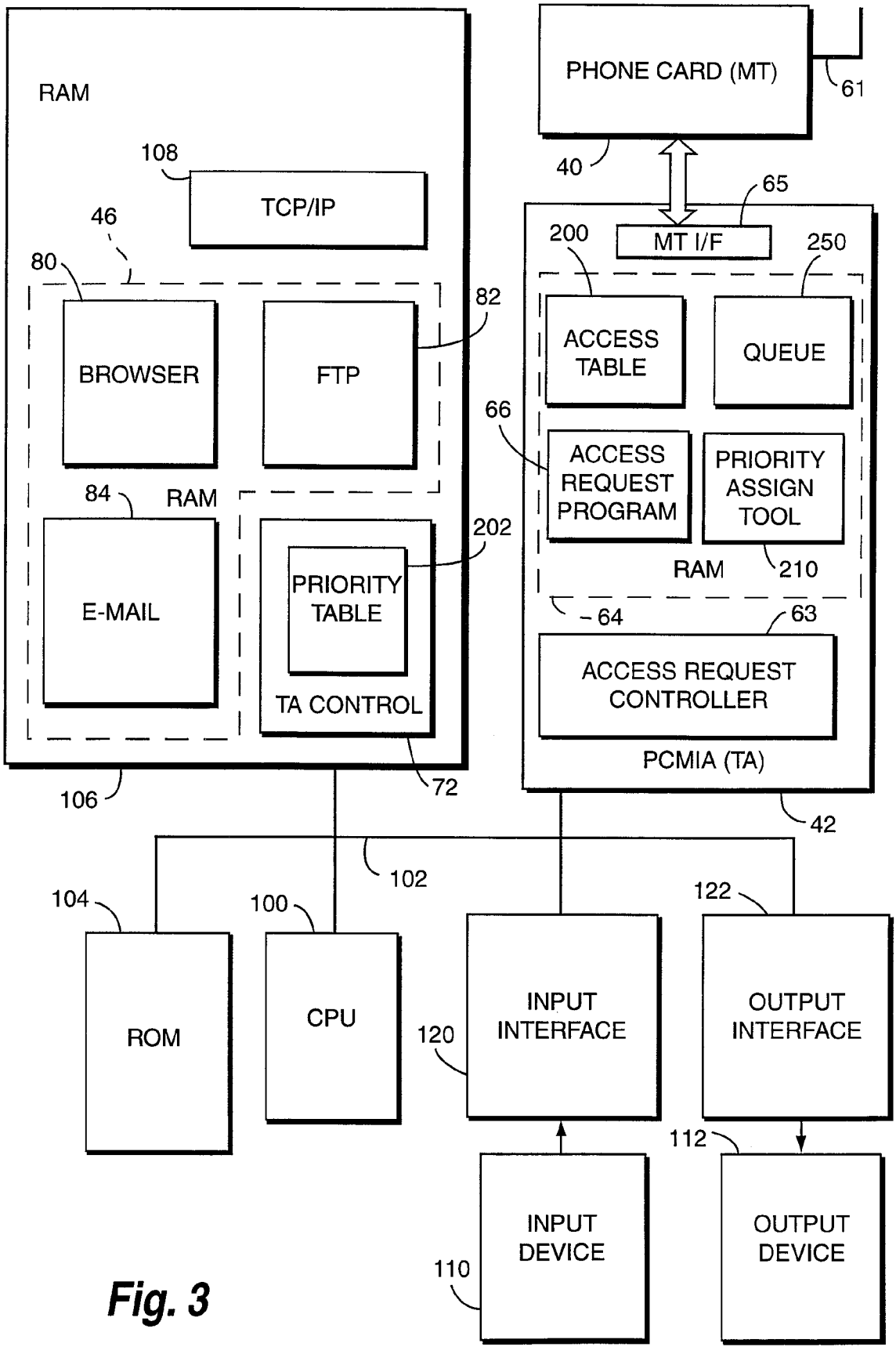

RAM
108
TCP/IP
46
80
BROWSER
FTP
82
84
RAM
E-MAIL
202
PRIORITY TABLE
TA CONTROL
106
72
PHONE CARD (MT)
61
40
65
200
MT I/F
250
ACCESS TABLE
QUEUE
66
ACCESS REQUEST PROGRAM
PRIORITY ASSIGN TOOL
RAM
210
64
63
ACCESS REQUEST CONTROLLER
PCMIA (TA)
42
102
104
100
122
ROM
CPU
INPUT INTERFACE
120
OUTPUT INTERFACE
112
INPUT DEVICE
110
OUTPUT DEVICE

Fig. 3

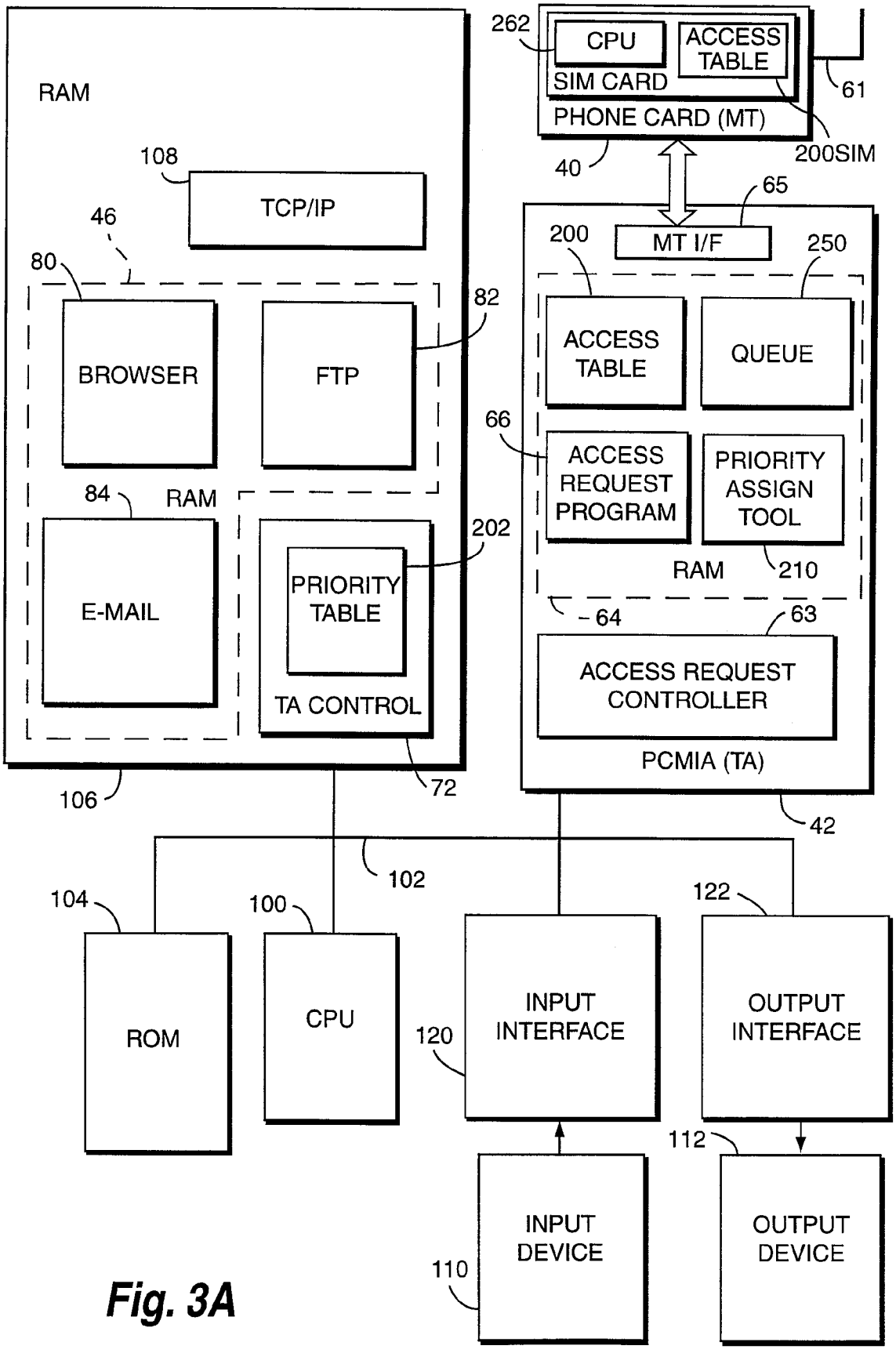

RAM
108
TCP/IP
46
80
BROWSER
FTP
82
84
RAM
E-MAIL
202
PRIORITY TABLE
TA CONTROL
72
106
262
CPU
ACCESS TABLE
SIM CARD
61
PHONE CARD (MT)
200SIM
40
65
MT I/F
200
250
ACCESS TABLE
QUEUE
66
ACCESS REQUEST PROGRAM
PRIORITY ASSIGN TOOL
RAM
210
64
63
ACCESS REQUEST CONTROLLER
PCMIA (TA)
42
102
104
ROM
100
CPU
120
INPUT INTERFACE
122
OUTPUT INTERFACE
112
INPUT DEVICE
110
OUTPUT DEVICE

Fig. 3A

Fig. 4

ACCESS TABLE	
ACCESS CLASSES PERMITTED BY SUBSCRIPTION AGREEMENT	ACCESS STATUS AS DETERMINED FROM NETWORK
ACCESS CLASS C0 4	PERMITTED
ACCESS CLASS C09	DENIED
ACCESS CLASS C14	DENIED

Fig. 5A

8	7	6	5	4	3	2	1	
	RACH CONTROL PARAMETERS IEI							OCTET 1
MAX RETRANS		Tx-INTEGER				CELL BARR ACCESS	RE	OCTET 2
AC C15	AC C14	AC C13	AC C12	AC C11	AC C10	AC C09	AC C08	OCTET 3
AC C07	AC C06	AC C05	AC C04	AC C03	AC C02	AC C01	AC C00	OCTET 4

Fig. 6

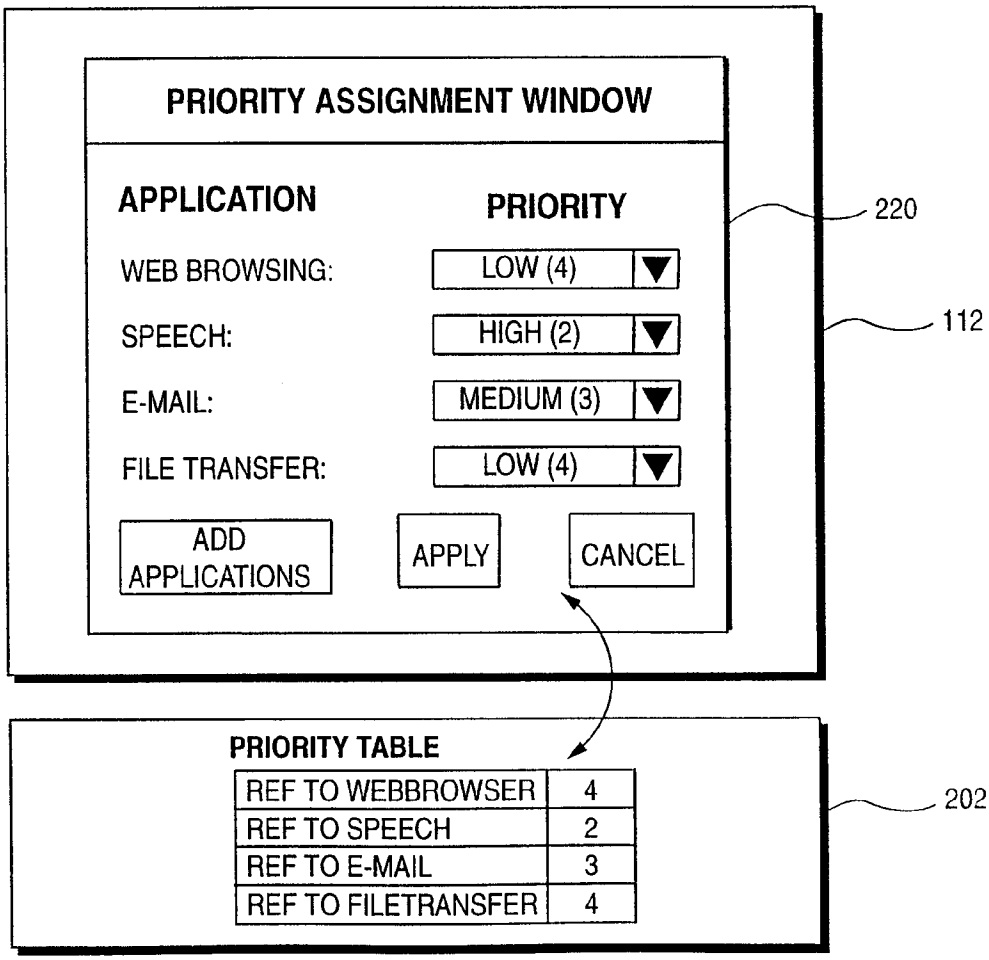


Fig. 5B

a1	a2	a3	a4	b1	b2	b3	b4	OCTET 0
c1	c2	c3	c4	d1	d2	d3	d4	OCTET 2
e1	e2	e3	e4	f1	f2	f3	f4	
g1	g2	g3	g4	h1	h2	h3	h4	
i1	i2	i3	i4	k1	k2	k3	k4	
l1	l2	l3	l4	m1	m2	m3	m4	
n1	n2	n3	n4	o1	o2	o3	o4	
p1	p2	p3	p4	q1	q2	q3	q4	
r1	r2	r3	r4	s1	s2	s3	s4	OCTET 7

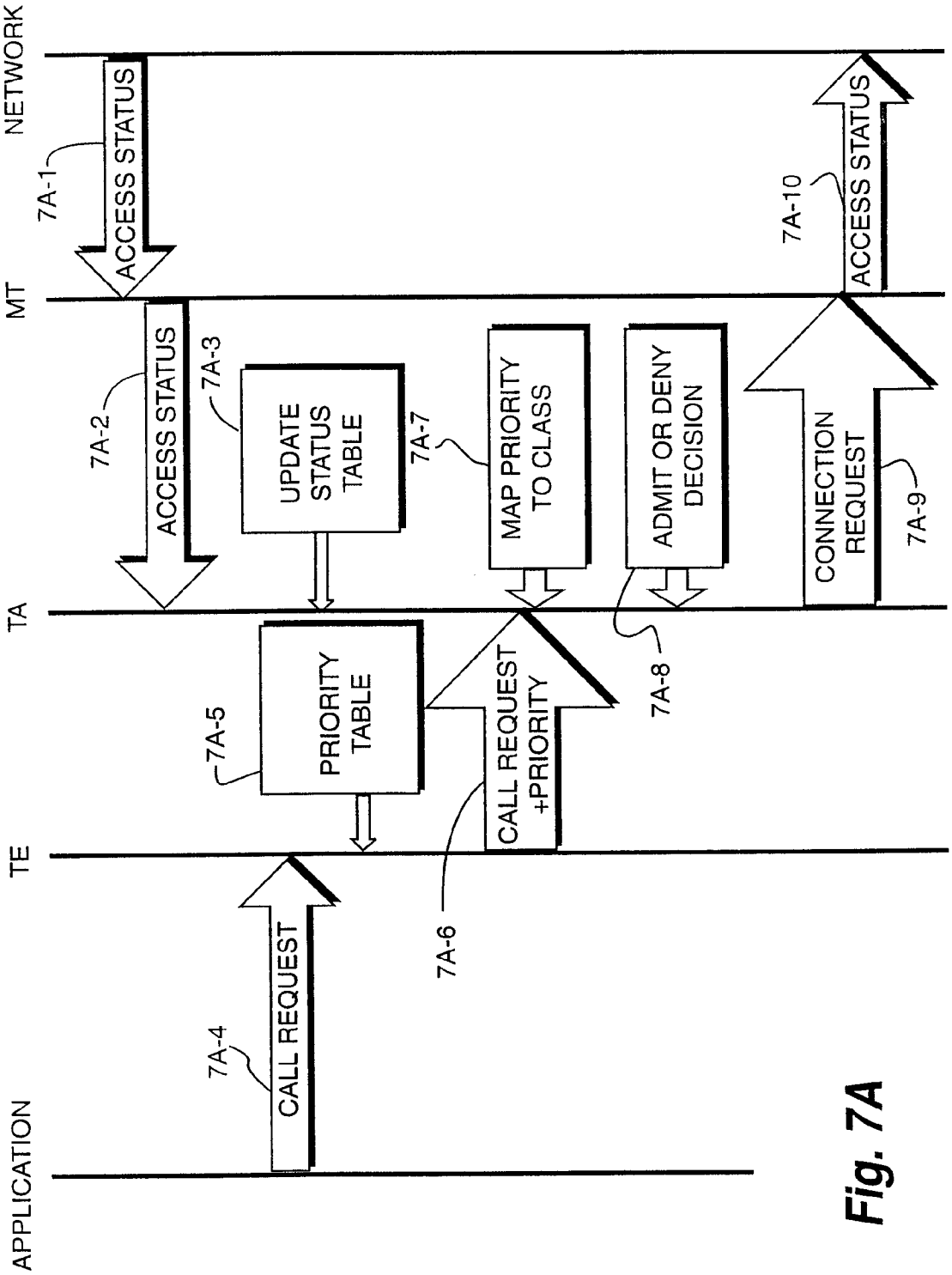

NETWORK
MT
TA
TE
APPLICATION
7A-1
ACCESS STATUS
7A-2
ACCESS STATUS
7A-3
UPDATE STATUS TABLE
7A-4
CALL REQUEST
7A-5
PRIORITY TABLE
7A-6
CALL REQUEST +PRIORITY
7A-7
MAP PRIORITY TO CLASS
7A-8
ADMIT OR DENY DECISION
7A-9
CONNECTION REQUEST
7A-10
ACCESS STATUS

Fig. 7A

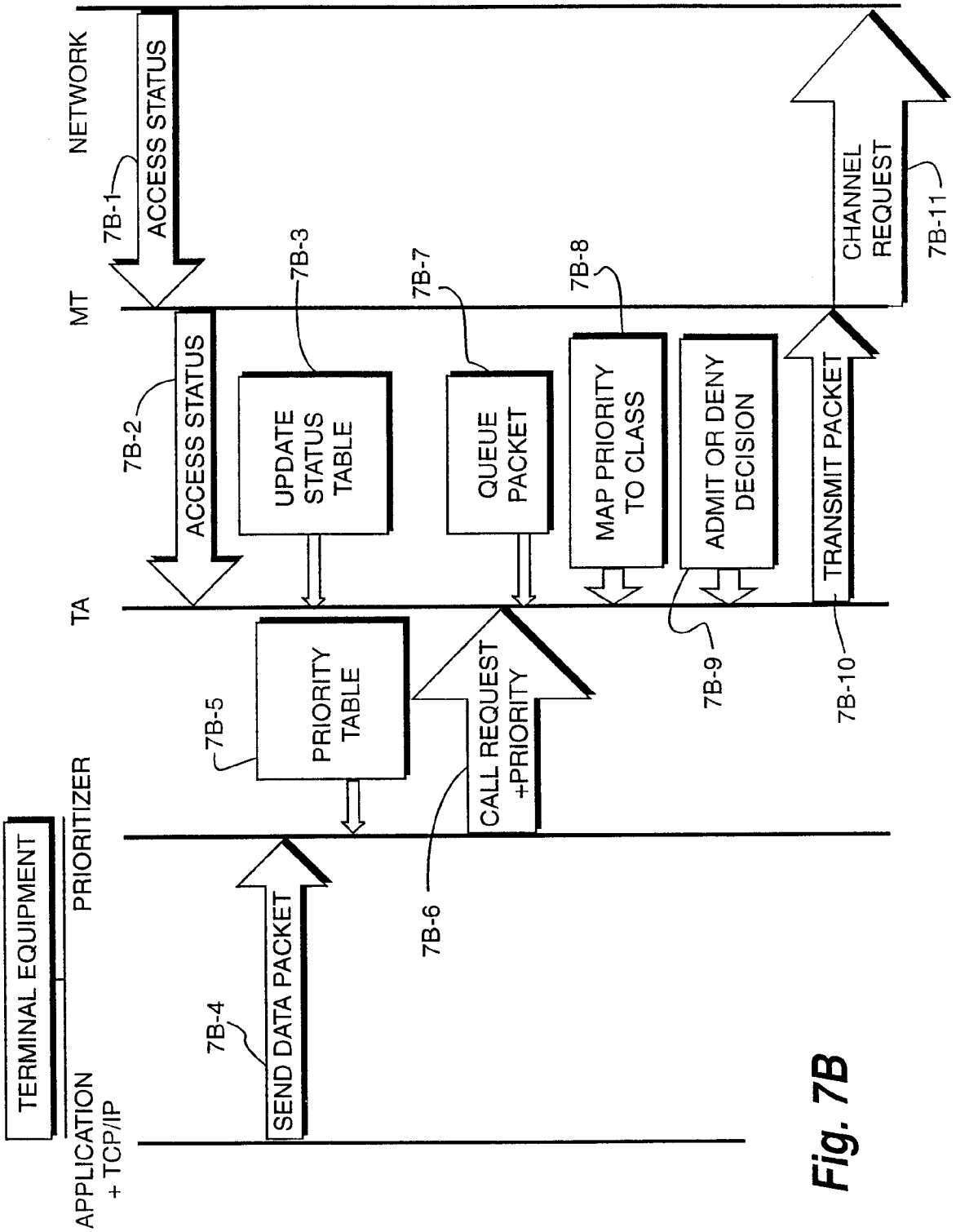

NETWORK
MT
TA
PRIORITIZER
TERMINAL EQUIPMENT
APPLICATION + TCP/IP
7B-1
ACCESS STATUS
7B-2
ACCESS STATUS
7B-3
UPDATE STATUS TABLE
7B-4
SEND DATA PACKET
7B-5
PRIORITY TABLE
7B-6
CALL REQUEST +PRIORITY
7B-7
QUEUE PACKET
7B-8
MAP PRIORITY TO CLASS
7B-9
ADMIT OR DENY DECISION
7B-10
TRANSMIT PACKET
7B-11
CHANNEL REQUEST

Fig. 7B

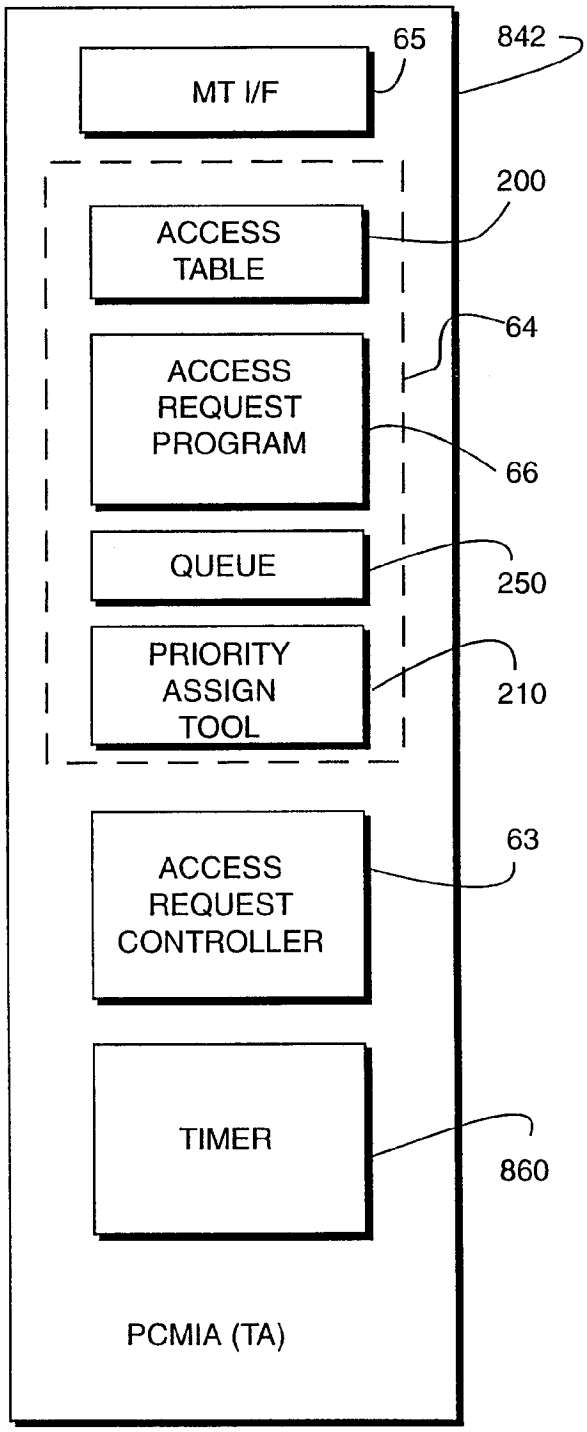

65
842
MT I/F
200
ACCESS TABLE
64
ACCESS REQUEST PROGRAM
66
QUEUE
250
PRIORITY ASSIGN TOOL
210
63
ACCESS REQUEST CONTROLLER
TIMER
860
PCMIA (TA)

Fig. 8

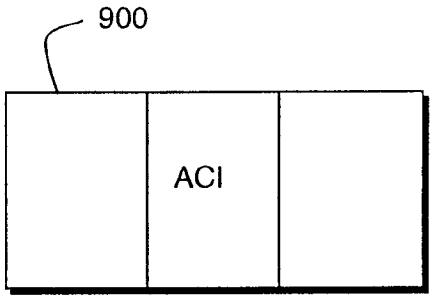

900
ACI

Fig. 10

Fig. 9

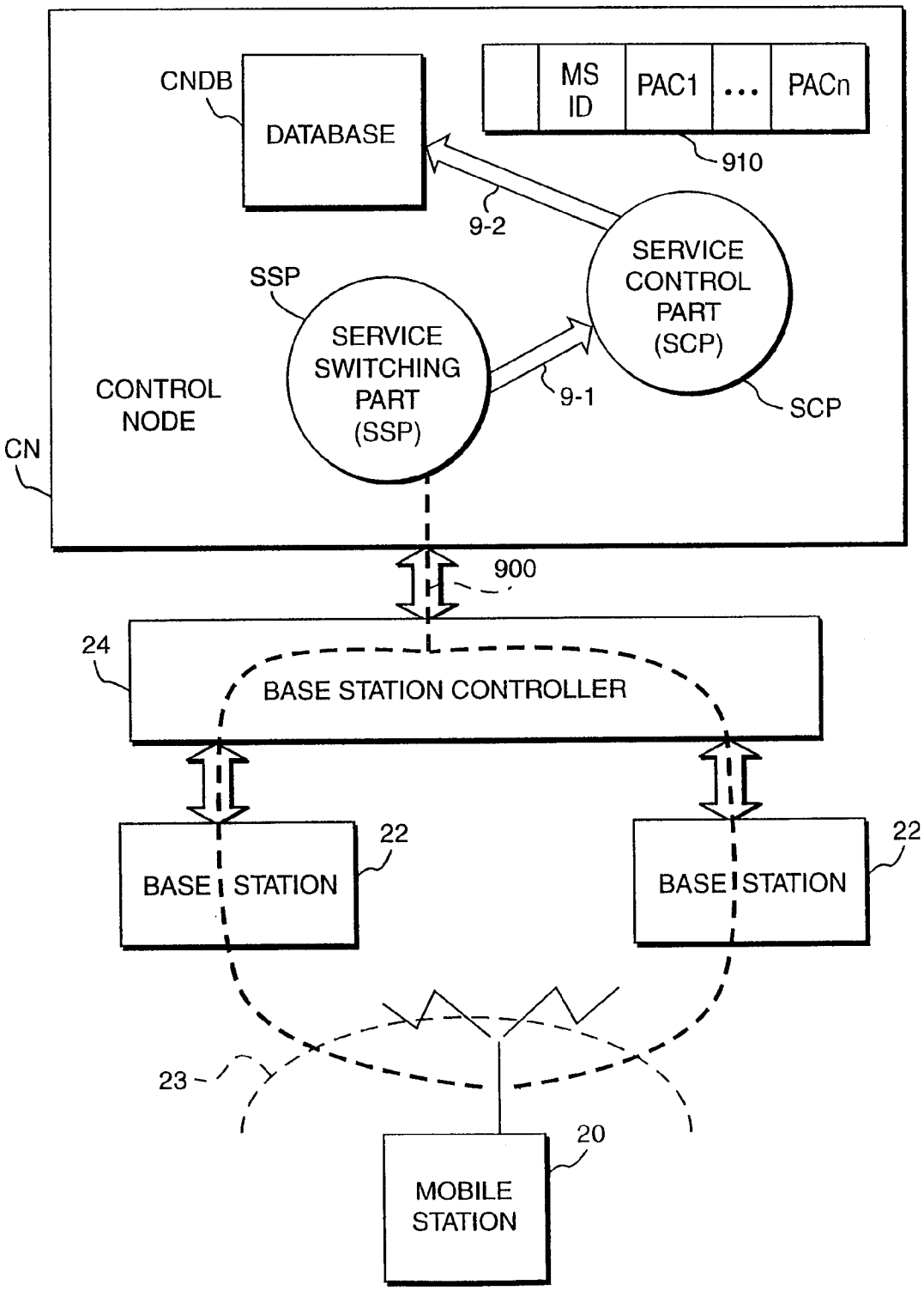
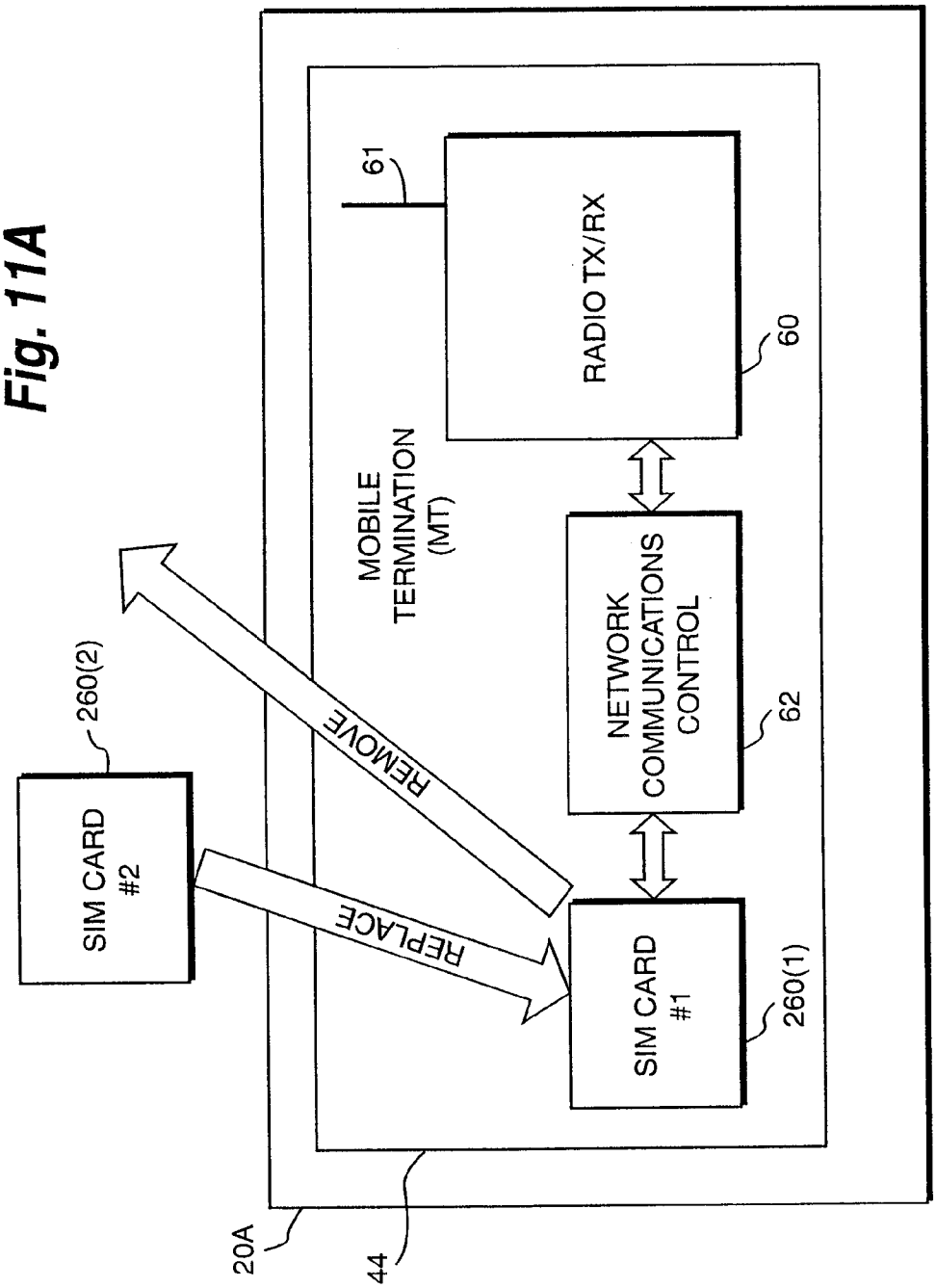

CNDB
DATABASE
MS ID
PAC1
...
PACn
910
9-2
SERVICE CONTROL PART (SCP)
SCP
SSP
SERVICE SWITCHING PART (SSP)
9-1
CONTROL NODE
CN
900
24
BASE STATION CONTROLLER
BASE STATION
22
BASE STATION
22
23
MOBILE STATION
20

Fig. 11A


61
RADIO TX/RX
60
MOBILE TERMINATION (MT)
NETWORK COMMUNICATIONS CONTROL
62
260(2)
SIM CARD #2
REMOVE
REPLACE
SIM CARD #1
260(1)
20A
44

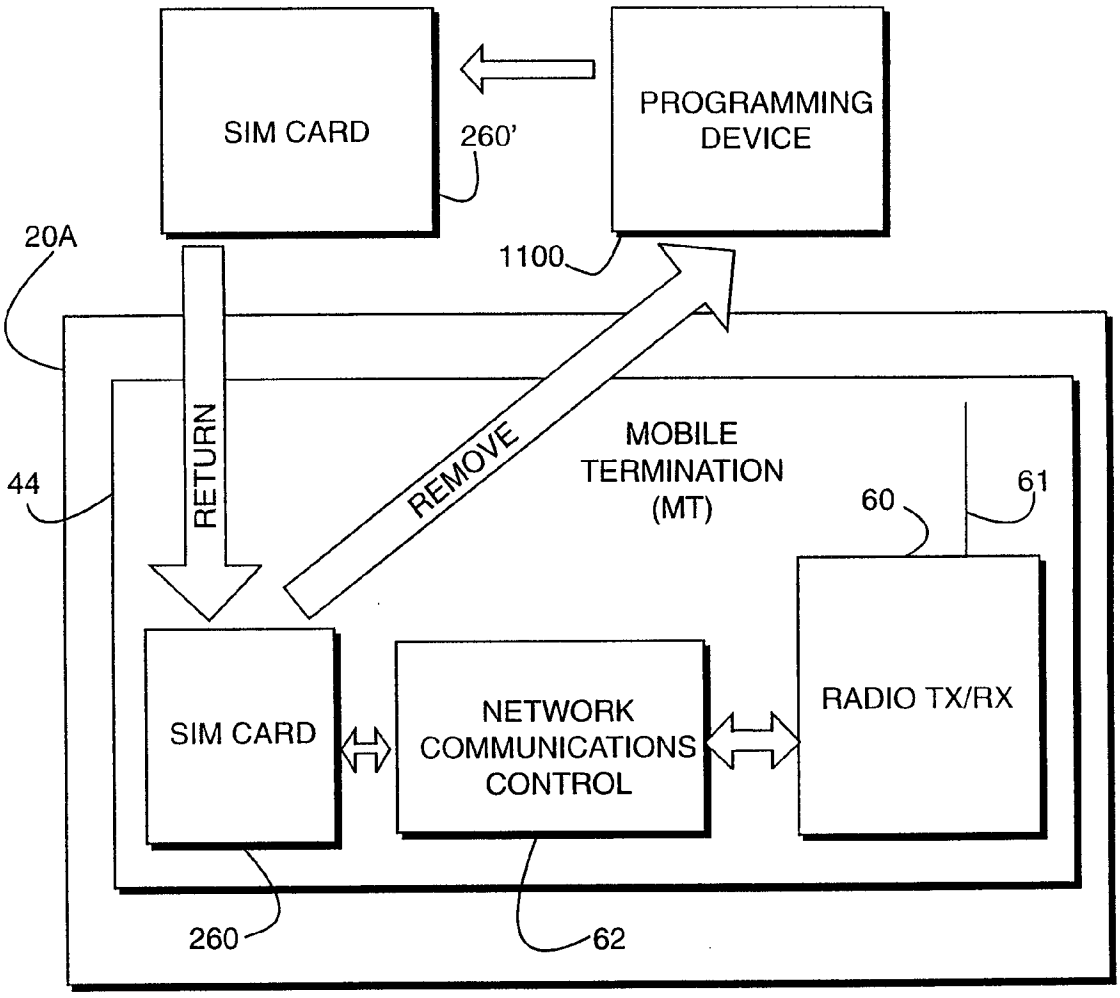

SIM CARD
260'
PROGRAMMING DEVICE
20A
1100
RETURN
REMOVE
MOBILE TERMINATION (MT)
44
60
61
SIM CARD
NETWORK COMMUNICATIONS CONTROL
RADIO TX/RX
260
62

Fig. 11B

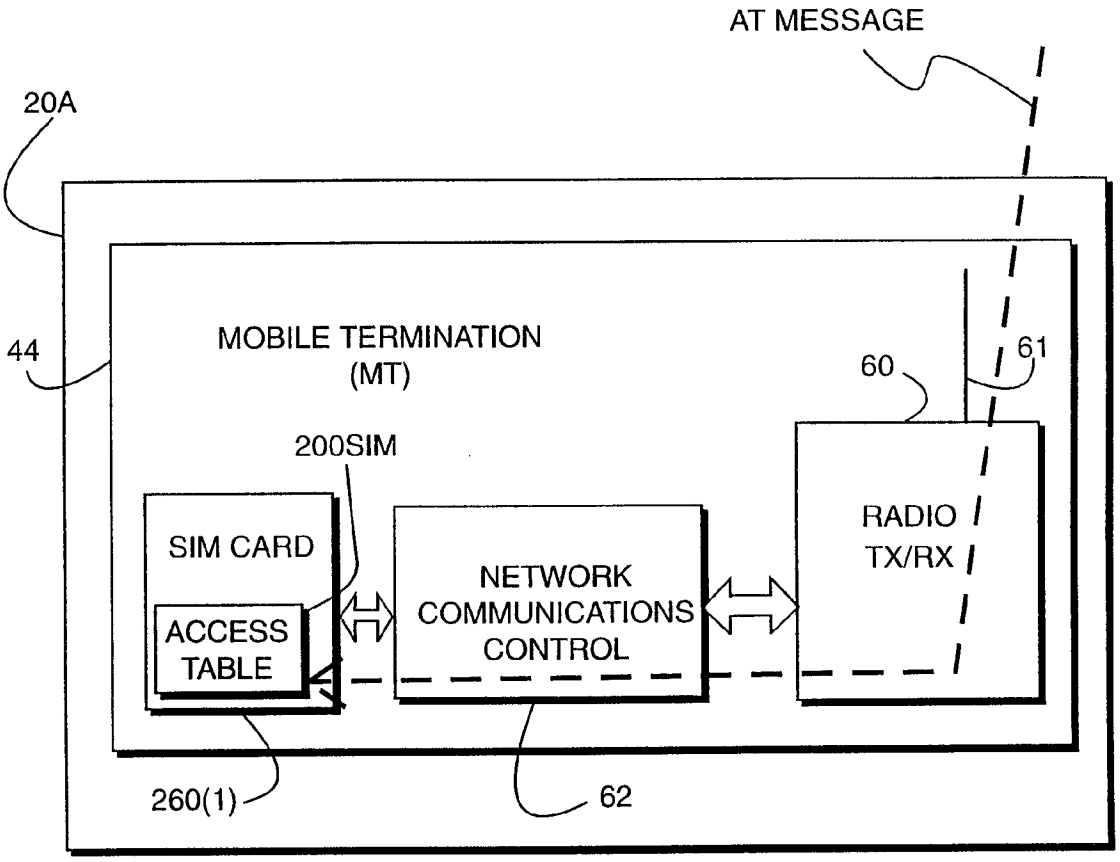

AT MESSAGE
20A
44
MOBILE TERMINATION
(MT)
60
61
200SIM
SIM CARD
ACCESS
TABLE
NETWORK
COMMUNICATIONS
CONTROL
RADIO
TX/RX
260(1)
62

Fig. 11C

INTERNATIONAL SEARCH REPORT

In. .ational Application No
PCT/SE 99/00281

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04Q7/32 H04L12/56 H04L29/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04Q H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 95 03679 A (NOMADIC SYSTEMS INC) 2 February 1995 see page 4, line 10 - line 33 see page 5, line 22 - page 6, line 10	1,3-5, 11,12, 27,28, 30,38, 39,43
Y	see page 6, line 15 - page 7, line 6	13,40
A	see page 7, line 10 - line 24	15

X	WO 97 19525 A (MOTOROLA INC) 29 May 1997 see page 4, line 1 - page 6, line 19 see page 10, line 13 - page 11, line 26	1,3,12
A	see page 14, line 8 - line 23	15

	-/--	

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
7 June 1999	17/06/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Baas, G

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Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/SE 99/00281

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	"ETSI; Interim European Telecommunication Standard I-ETS 300022, European digital cellular telecommunication system (phase 1), Mobile radio interface layer 3 specification" GSM 04.08,May 1992, XP002088537 cited in the application see page 338 - page 340; figure 10.36; table 10.30 ---	41,42
Y	US 5 574 728 A (MAMAGHANI FARZAN ET AL) 12 November 1996 see column 1, line 11 - line 52 see column 2, line 12 - line 47 ---	13,40
A	EP 0 782 364 A (LSI LOGIC CORP) 2 July 1997 see column 3, line 6 - line 13 see column 4, line 47 - column 5, line 57 -----	1,15,27

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

In ıational Application No
PCT/SE 99/00281

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9503679 A	02-02-1995	NONE	
WO 9719525 A	29-05-1997	US 5729542 A	17-03-1998
		EP 0804834 A	05-11-1997
US 5574728 A	12-11-1996	CN 1142739 A	12-02-1997
EP 0782364 A	02-07-1997	JP 9219890 A	19-08-1997